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Science



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# SCIENCE 1003 MICROBIOLOGY

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# MICROBIOLOGY

Microbiology is the study of organisms too small to be seen with the unaided eye. The microscopic organisms include the protozoans, algae, fungi, and bacteria. In addition, two other groups—the rickettsias and viruses—are too small to be studied with an ordinary light microscope. Rickettsias are much smaller than bacteria but larger than viruses.

Microorganisms display great diversity in appearance, locomotion, reproduction, and methods of getting food. They are innumerable.

The number of bacteria in a glass of soured milk is numerous.

In this LIFEPAK® you will study some of the smallest organisms the Lord has created. Since they are characterized by such diversity, you will learn only a few representatives of each group.

Psalm 104:24-25 states, "O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches. So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts."

## OBJECTIVES

**Read these objectives.** The objectives tell you what you will be able to do when you have successfully completed this LIFEPAK.

When you have finished this LIFEPAK, you should be able to:

1. Discuss the history and development of the microscope as related to microbiology.
2. List and describe some different types of microscopes.
3. Calculate the amount of magnification.
4. Discuss some techniques in the use of the microscope that will help you in your study of microbiology.
5. Describe the three groups of protozoans based on their method of movement.
6. Name the major structures and describe the function of these parts for each of the representative types of protozoans.
7. Perform culture techniques for protozoans.
8. List some ways in which protozoans are of economic importance.
9. Name and describe the major groups of algae.
10. Collect and identify some freshwater algae.
11. Tell some ways in which algae are of economic importance.
12. Recall and write some Scripture concerning the Lord as Creator-Savior.
13. Collect, describe, and identify some common fungi.
14. Discuss the economic importance of fungi to man.
15. Survey the major characteristics of bacteria, rickettsias, and viruses.

Survey the LIFEPAC. Ask yourself some questions about this study. Write your questions here.

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## I. THE MICROSCOPE

Magnification is required to study **bacteria**, **fungi**, **protozoa**, and most **algae**. Seaweed, an alga, is an exception. **Viruses** and **rickettsias** are submicroscopic: They cannot be studied with an ordinary light microscope. They can, however, be examined with an **electron microscope** which

requires special preparation of the specimen.

In this section of the LIFEPAC, you will study a brief history of the microscope. You will review some techniques of the microscope which will help you in your study of microbiology.

### SECTION OBJECTIVES

**Review these objectives.** When you have completed this section, you should be able to:

1. Discuss the history and development of the microscope as related to microbiology.
2. List and describe some different types of microscopes.
3. Calculate the amount of magnification.
4. Discuss some techniques in the use of the microscope that will help you in your study of microbiology.

### VOCABULARY

**Study these words** to enhance your learning success in this section.

algae (alga)

fungi (fungus)

resolving power

bacteria (bacterium)

microscopic

rickettsia

binocular

monocular

virus

electron microscope

protozoa

**Note:** All vocabulary words in this LIFEPAC appear in **boldface** print the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

## HISTORY OF THE MICROSCOPE

Magnifying lenses date back to A.D. 1000 or earlier. The Arabs were using them for experiments by then. Early microscopes consisted of a single lens. Today they would be considered magnifying glasses.

The exact origin of the *compound microscope* is not known. Some attribute it to Zaccharis Jansen, a Dutch spectacle maker, around 1590. Anton van Leeuwenhoek (Lay' ven hook) was one of the earliest and most skillful microscope makers. Leeuwenhoek (1632-1723), a Dutch student of natural history, made several hundred lenses. He was the first to describe microorganisms

accurately. He made careful observations and descriptions of sperm cells, **bacteria**, **protozoa**, and yeasts. He described rainwater as having a great multitude of "animalcules." He also made accurate drawings of bacteria in saliva and in vinegar. Leeuwenhoek reported his findings to the Royal Society of London. Galileo (1610) and Robert Hooke (1665) both used compound microscopes that resemble modern microscopes. Hook observed and made accurate drawings of cork. He named the little compartments *cells*, because they resemble the cells, or chambers, in a beehive.



Complete these statements.

- 1.1 The seventeenth century scientist who observed cork and named the little compartments *cells* was \_\_\_\_\_ .
- 1.2 Leeuwenhoek made careful observations and descriptions of a. \_\_\_\_\_ ,  
b. \_\_\_\_\_ , c. \_\_\_\_\_ , and d. \_\_\_\_\_ .
- 1.3 Magnifying lenses were in use as early as \_\_\_\_\_ .
- 1.4 The exact origin of the compound microscope is not known. It may have originated around 1590 with \_\_\_\_\_ .

## TYPES OF MICROSCOPES

Two basic types of microscopes are in use today, the light (optical) microscope and the **electron microscope**.

**The light (optical) microscope.** Several variations of the light microscope have been developed to meet specific needs. The ordinary light microscope is called a *bright-field* microscope because the area, or field, of vision is brightly illuminated and the object appears darker. Bright-field microscopes are used for most **microscopic** work.

A modification of the light microscope produces a dark field for background. Essentially this variation is a light microscope with a special condenser lens that makes the specimen appear light on a dark background. This type of microscope is used primarily for unstained specimens, and is called a dark-field microscope.

Further modification of the light microscope can produce greater contrast or phases of contrast. *Contrast*, as on a television set, is the difference in visual tones of the object being viewed. A set of condenser lenses can be added to the light microscope to produce greater contrast. This system of controlled illumination makes possible the distinguishing of details which vary only slightly in thickness. This technique is especially helpful in identifying parts within a cell, and it is the basis of a *phase-contrast* microscope.

**The electron microscope.** The electron microscope is necessary for examining **viruses** and **rickettsias**. It uses streams of electrons and magnetic fields, much like a television or an oscilloscope. The image may be viewed on both a fluorescent screen and photographic film. Electron microscopy has the two-fold disadvantage of

requiring extensive preparation of the specimen and of being comparatively very expensive.

In the preceding discussion microscopes have been divided into two groups: electron microscopes and light microscopes (with variations). Microscopes can be divided also according to the number of tubes for viewing. A

**monocular** microscope has a single body tube with its corresponding eyepiece. If two body tubes are present, the microscope is said to be **binocular** (mono = one, bi = two, ocular = eye). The binocular microscope prevents the eyes from becoming tired because both eyes are used at one time.



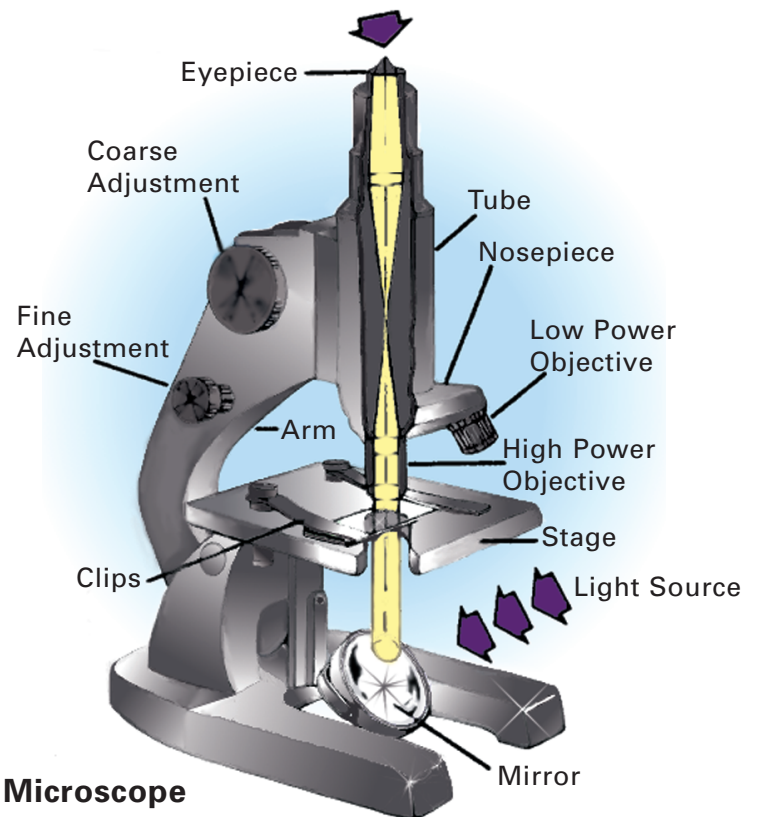
**Complete these activities.**

- 1.5 Two varieties of optical microscopes, with respect to the image they produce, are  
a. \_\_\_\_\_, and b. \_\_\_\_\_.
- 1.6 A *monocular* microscope has \_\_\_\_\_.
- 1.7 The ordinary light microscope is called a bright-field because \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.
- 1.8 The prefix *bi* means \_\_\_\_\_.
- 1.9 Tell two disadvantages of the electron microscope.  
a. \_\_\_\_\_  
b. \_\_\_\_\_
- 1.10 Describe a binocular microscope. \_\_\_\_\_  
\_\_\_\_\_

**TECHNIQUES OF MICROSCOPY**

A compound microscope is capable of several powers of magnification and is easily adjustable from one to the next.

**Techniques for low power.** In the following exercise you will go through the steps of using the microscope on low power. Low power is used for scanning a slide. Perform each step before you begin the experiments in this LIFEPAAC.



**Figure 1: Light Microscope**